§ 3. Report on Improvements of an Access Control System Developed for LHD Controlled Area

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An access-control system has been developed for the safety operation of the large helical device (LHD) at the National Institute for Fusion Science. The central part of the control system consists of a main computer, a manual-operation box and a sequencer-control system. The system monitors five turnstiles, eight shielding doors and other points of entry and directly supplies the interlock signals to the LHD control system.

It entered practical use at the time the plasma experiment using the LHD began. Since then, the access-control system has been operating for five years and we have improved the system every year based on the experience we gained. As a result, the system is almost completed, although a few problems remain to be resolved. The present report provides details especially focusing on improvements of the access control system made so far.

After starting to use the access control system, we encountered various problems. In each case, we examined and resolved it. In the following subsections, we discuss five cases that typify the problems we actually experienced.

Power breakdown: The present system was designed considering possible states of emergency. However, there was recently an unexpected power outage caused by trouble at a sub-station. This resulted in all the turnstiles being locked. As this problem has not been completely settled yet, we should overcome it by resorting to manual operation: using a turnstile release key to mechanically unlock it independently of the automatic system operation. We must establish practical emergency measures before such trouble happens again.

Double reading: In practice, when various human accesses occur, there is a chance of the card reader misreading a user's ID card. Typically, the person must retry his card. Another case is when a person leaves without going through the turnstile, although the card reader read his ID card well and he was recognized as a person permitted to enter. To adapt the system to handle these situations, we made an operation program so that the most recent data was recorded by overwriting if several reading data were generated at one access, so the data being read are not recorded unless the turnstile bar rotates.

Shortly after the system began operating, some inconvenience related to this program occurred. Since the access control system was under development, we often had to examine the operational status of the system based on access data concerning both system and people. So we amended the operation program in order to record all the access events. As a result, the quantity of daily data increased and much more time was required to reduce the data than before. However, all data should be recorded as long as we continue development and improve the access control system. The program amendment was a temporary measure we took along the path to system completion. The present amended program will be returned to the state before the amendment when the study is completed.

Time lag: In our system, several sequencers are used to speed up the data processing. Each sequencer has an internal clock and checks the time whenever an access event, such as a human going in or out, occurs. As each clock separately and independently moves in the respective sequencers, a difference in time (time lag) can arise due to the sequencers after a long time. This time difference may produce a discrepancy where the entry time is recorded as being after the corresponding exit time. That is, the order of events is reversed by the time lag. As a fundamental solution to this problem, we employed a function for correcting the time of the sequencers' clocks against the main computer's clock once a day. After this correcting function was installed, these problems did not occur again.

Renewal of individual information: Information on each person is used to perform access control. The information is first input into the main computer, and then sent automatically to the sequencers to update personnel data at the end of each day. Under this policy, the new information input into the main computer is not effective for access control until after the end of each day. To make it effective immediately, we amended the operation program so that the information is promptly sent manually from the main computer to the sequencers.

Crowds of visitors: Our facilities receive many visitors to observe the LHD in the LHD controlled area. These enter the LHD controlled area temporarily, although they are not registered as authorized people and are not assigned a specific ID card. Consequently, when visitors enter the LHD controlled area, we give them a temporary guest card for a visit. A guest card is not assigned to a specific person and is used repeatedly by many different visitors. However, the card system for visitors is often inconvenient for a large number of visitors, e.g., twenty or so, because there are only one or two turnstiles per entrance. One way to resolve this problem might seem to be to add extra turnstiles at an entrance, but actually that would be impossible considering the high cost and lack of entrance space. Therefore, we decided to use the turnstile release key. In this situation, we should not forget to make handwritten access records in a logbook in place of the automatic access control system. In the future, we must study how to automatically check a large number of people including visitors and allow them to enter quickly.

In this report, we described the access control system, including several problems. This system is in operation and has performed its role successfully. We consider it our duty to strive to further improve this system. Based on the present study, further research, development, and improvement of the access control system for future fusion facilities will continue.